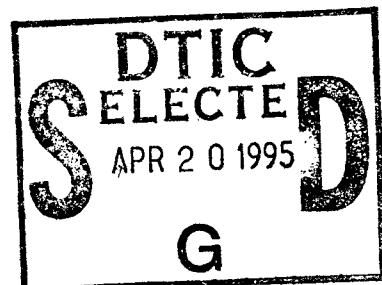
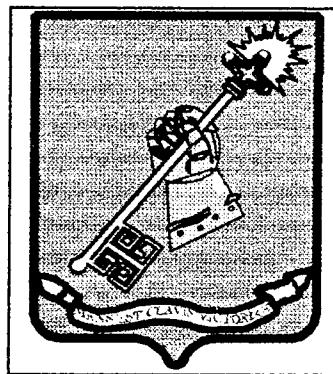


**THE STRONGER FORM OF WAR:
THE EFFECTS OF TECHNOLOGICAL CHANGE ON
THE BALANCE BETWEEN ATTACK AND DEFENSE**

**A Monograph
by**

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**School of Advanced Military Studies
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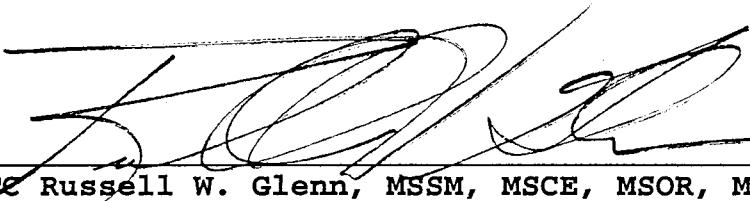
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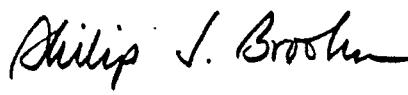
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ABSTRACT

Clausewitz's model of war postulates that the attack has a positive aim but the defense is the stronger form of war. Armies past and present have generally accepted the superior strength of the defense, but the degree of superiority has varied with changes in technology. This study examines the sources of defensive strength in an attempt to develop tools for evaluating the effect of future technology on the balance of offense and defense. Defense has two key advantages over attack: the defender has less need to move than the attacker and the defender controls the ground over which he must move. Most of the defender's advantages in firepower, protection and leadership derive from these two strengths. The attacker can attempt to overcome the advantages of the defense by employing new technology or methods. A new weapon or capability that helps both the attacker and the defender may help one more than the other. The First World War provides good examples of how technological change affects the balance between attack and defense. The Persian Gulf War demonstrated the effectiveness of modern military technology. The development of long-range precision weapons may not merely shift the balance between attack and defense, but may obscure the distinction between the two. The result is a dichotomy: The offense may be the stronger form of air and long-range missile war, while the defense is the stronger form of land war.

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TABLE OF CONTENTS

I. Introduction	1
II. The Sources of Defensive Strength	4
Maneuver	4
Firepower	9
Protection	13
Leadership	18
Time	24
III. Technology and the Balance of Offense and Defense.....	25
World War I: The Western Front	25
The Persian Gulf War.....	30
Attack and Defense in Future War	34
IV. Conclusion: Understanding the Sources of Defensive Strength.....	36
Endnotes	40
Bibliography	43

I. Introduction

Like most armies, that of the United States emphasizes offensive action in its doctrine. The U.S. Army includes “Offensive” as one of its principles of war, and the U.S. Army’s keystone doctrinal manual, FM 100-5, states that “the offense is the decisive form of war.”¹ However, the U.S. Army also acknowledges that the defense is the stronger form of war. A defender may defeat a much stronger attacking force. That defense is the stronger form of war has generally been accepted since ancient times; Sun Tzu wrote in c. 500 B.C. that “invincibility lies in the defense.”² Modern military theorists associate the idea most closely with Carl von Clausewitz. Clausewitz argues that the defense is the stronger form of war, but he also notes that it has a negative aim--it cannot achieve positive results in itself. To employ the defense to too great an extent would therefore be a logical absurdity, a strategy suited only to armies so unimaginative as to be devoid of positive aims. Only the attack can achieve positive result.

Why then do whole armies often rely on the defense as their primary strategy for months or even years? They do not necessarily lack positive aims, but they may lack the strength to pursue those aims. An army that does not have the means to attack may yet have the means to defend. The strength of the defensive form of war makes up for the weakness of the military forces, so a defender does not need as much strength as does an attacker. Sun Tzu recommended the attacker have a five-to-one advantage over the

defender.³ The U.S. Army commonly accepts that an attacker needs at least a three-to-one advantage to overcome a prepared defense.⁴ The army of the former Soviet Union also called for a three-to-one ratio, but it preferred greater odds whenever possible.⁵ Let us set aside the difficulties of calculating force ratios; the ratios themselves show that modern armies support Clausewitz's assertion that defense is the stronger form of war.

The ratios also suggest the degree to which defense is stronger. However, the relative strength of the defense has varied over history. On the Western Front in 1915-1916, the defense proved so strong that every major offensive action cost horrendous casualties without achieving any significant success. By 1939, the offensive had regained enough relative strength that the Germans were able to launch *Blitzkrieg* invasions that overwhelmed Poland and France. The strength of the defense on the Western Front in World War I has been attributed to the development of barbed wire and the machinegun; the resurgence of the offense in World War II has been attributed to the refinement of the tank. Although other factors also affected the relative strength of attack and defense, technology clearly played an important part.

A question that emerges from this discussion is: Where do we stand now? If the relative strength of the offense and defense is in some degree a function of the technology of war, what are the effects of modern technology? Military technology has changed more since World War II than it did between 1915 and 1940. Technology will continue to change at a rapid pace in the future. How will such change affect the relative strength of attack and defense? Before we can answer this question, we must understand the factors

that make defense the stronger form of war. We can then try to understand how modern technology will affect these factors.

This study will analyze the strengths of the defense in a generic or abstract form to identify what gives defense its strength and how technology affects the strength of the defense. To keep the topic manageable, the study will focus on tactical land warfare. Air forces and the operational level of war will be addressed only in the context of their effects on tactical ground operations. The analysis will assume that attackers and defenders have equivalent technology and force structures. This is rarely so in the real world, but it is necessary in order to isolate the strengths that derive from the defensive form of war.

Analysis of the defense will encompass all actions of the defending side, including some that appear offensive, such as counterattacks, spoiling attacks, and deep strikes. Every defense contains elements of the offense, just as every attack contains elements of defense. As Clausewitz explains it, “The defensive form of war is not simply a shield, but a shield made up of well-directed blows.”⁶

Terrain is integral to land warfare. It is the playing board on which the dynamics of attack and defense take place. Without terrain, attack and defense become almost indistinguishable except in their positive or negative purposes. This is the case in aerial combat or naval battles on the surface of an open ocean. The greater the effects of terrain on military operations, the greater the degree to which defense will tend to be the stronger form of war on land. Terrain that restricts movement or masks observation and fires usually favors the defense. Exceptions derive mainly from the presence of offensive elements in every defense and defensive elements in every attack.

II. The Sources of Defensive Strength

The U.S. Army's keystone doctrinal manual, Field Manual 100-5, *Operations*, lists four elements of combat power: maneuver, firepower, protection, and leadership. One of the primary authors of the 1986 version of FM 100-5, Brigadier General Huba Wass de Czege, explains the elements in greater detail in a separate paper, "Understanding and Developing Combat Power."⁷ This study will use the four elements of combat power as the basis for examining the strengths of the defense. The discussion will also address the importance of time in the strength of the defense.

The strengths of the defense are relative. Whatever makes the defense stronger necessarily makes the offense weaker and vice versa. Developments that benefit both sides will usually benefit one more than the other, creating an asymmetrical advantage. For example, the tank is useful in both attack and defense, but because of its mobility it helps the attacker more than the defender. Tanks thus give an asymmetrical advantage to the attacker. The defender benefits from having tanks but would be better off if neither side had tanks. This study will return several times to the concept of asymmetrical advantage.

Maneuver

FM 100-5 defines maneuver as "the movement of combat forces to gain positional advantage, usually in order to deliver--or threaten delivery of--direct and indirect fires."⁸ Commanders move their forces to position them at decisive points that allow them to achieve shock, surprise, moral dominance, and fire superiority. Wass de Czege evaluates

maneuver in terms of maximizing one's own ability to employ firepower versus minimizing the opponent's ability to do so.⁹

Both attacker and defender must maneuver, but they may do so in different ways. Offensive and defensive maneuver differ in the relative emphasis each places on *movement* and *position*. The attacker must move his forces. If the attacker cannot move, he cannot maneuver; if he cannot maneuver, he cannot win.¹⁰ Movement is also important for the defender, but it is not necessarily essential. As FM 100-5 points out, the defender can achieve the effects of maneuver by allowing an enemy to move into a position of disadvantage.¹¹ The defender may occupy an advantageous position before the fight begins. The position may be advantageous in itself or the movement of the attacker may make it so. As Clausewitz noted, the attacker's forward motion brings him into the ground held by the defender. Unless the attacker advances on a very broad front--which requires an enormous preponderance of combat power--he creates exposed flanks that the defender may counterattack.¹²

The differences between offensive and defensive maneuver tend to favor the defender. The attacker gains one important advantage from maneuver, while the defender gains two. The defender's two advantages are that he has less need to move than does the attacker and he is more likely to control the ground over which he must move. The attacker's advantage is the initiative: the attacker chooses where to direct his main effort and sets the tempo of the battle. As Clausewitz says, "The one advantage the attacker possesses is that he is free to strike at any point along the whole line of defense, and in full force."¹³ To take this advantage, the attacker must coordinate the disparate elements of

his “full force” to strike at the chosen time and place. This is never easy, and as Clausewitz pointed out, “Any omission of attack...accrues to the defender’s benefit.”¹⁴

Movement entails certain difficulties. A moving force must temporarily give up some elements of protection, including cover and concealment. Movement causes a degradation of firepower. It complicates leadership. These difficulties will be discussed in more detail in the sections on firepower, protection, and leadership. The important consideration here is that the difficulties of movement apply more to the attacker than to the defender because the attacker has a greater need to move. This is not to say the defender can be completely stationary. He must move into initial positions, he must move supplies forward, he must reposition weapons during the battle, and he must move reserves and counterattack forces. Nevertheless, the defender generally moves less than does the attacker. Less of the defending force must move, and those that move do so over shorter distances.

When the defender must move, he is more likely to do so over ground that he controls. The reasons for this are obvious. The defender’s reserves, supply columns, and counterattack forces move behind the protection of his forward positions. The attacker must drive the defender from these positions; to do so he must move his forces into terrain that the defender contests (see Figure 1, below).

“Control” is subjective: neither side controls the no-man’s land between the main forces, and the defender cannot be said to fully control terrain he occupies if it is subject to enemy fires. In most instances, the geometry of the battlefield ensures that the defender will have much greater control of the ground over which he must move than will the

attacker. Even if the defender does not fully control the terrain at the time he must move over it--such as on a nonlinear battlefield or during a counterattack--he will likely have controlled it earlier and will have gained some advantage thereby.

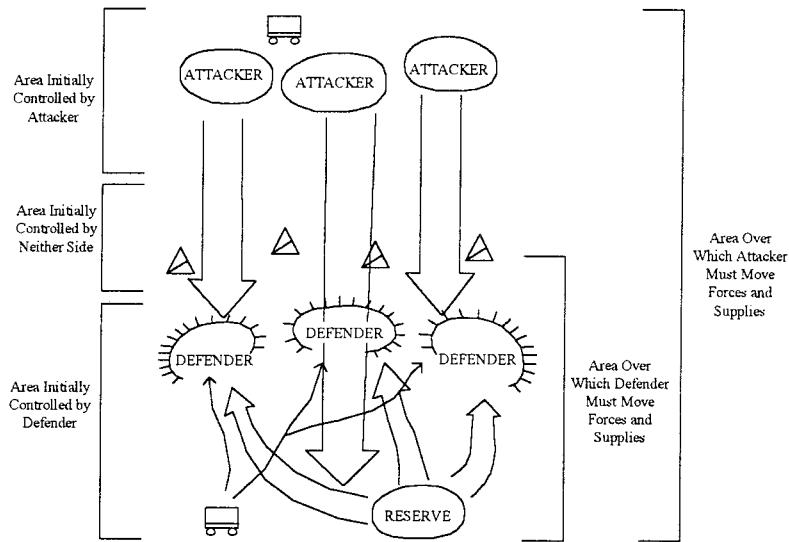


Figure 1--The defender generally moves over areas he controls, whereas the attacker must move over area controlled by his opponent.

There are several benefits of controlling the ground over which one must move. First and most obvious is that movement is easier if the enemy cannot place physical obstacles or direct fires along the route over which one intends to move. The defender is less likely to have to breach obstacles or pass through enemy fires to get his forces into position. Conversely, the defender is able to place obstacles in the path of the attacker and can cover these obstacles with observed fires.

The defender's second advantage of controlling the ground is a greater ability to conceal his activities. The defender generally moves his forces behind the protection of his

forward positions, out of visual range of opposing ground observers. Only with difficulty can the attacker send reconnaissance beyond enemy lines to observe his movements. The defender, however, can place observation posts to conduct passive surveillance along the routes by which an attacker is likely to approach. Observation posts are more easily emplaced and more difficult to detect and counter than are the attacker's reconnaissance patrols. Because of these factors, Clausewitz believed the defender could achieve surprise more effectively than could the attacker. Although the attacker may gain some element of surprise in his choice of where to direct his main effort, "...the defender is better placed to spring surprises by the strength and direction of his own attacks."¹⁵

A third advantage of controlling the ground over which one must move is one may rehearse the movement ahead of time. A counterattack force can practice moving along a planned route to determine how much time the movement requires and to ensure that key personnel know where to go. The attacker generally cannot rehearse over the actual ground of his attack.

A fourth and related advantage of controlling ground is that one can acquire detailed knowledge of the terrain. The knowledge improves the more time the defender has to familiarize himself with the area. The defender can learn before the battle begins which roads are best and what obstacles exist on the battlefield. This knowledge, like the ability to rehearse movements, translates to advantages in the leadership element of combat power. The advantages of controlling ground apply to movement of supplies as well as combat forces. Movement of supplies is part of the protection element of combat power and will be addressed again later.

As we shall see, the defender's two greatest advantages in maneuver--having less need to move and controlling the ground over which he must move--form the basis for most of his other advantages. Most of the defender's advantages increase the longer he controls the ground; this continues to hold true for the derivative advantages in firepower, protection, and leadership.

Firepower

Firepower is the destructive force that can be delivered by a position, unit, or weapons system. It includes both direct and indirect fires. Wass de Czege evaluates the effects of firepower in terms of volume of fire, lethality of munitions, accuracy of fires, target acquisition, and flexibility of employment. Firepower complements maneuver by suppressing enemy forces; maneuver complements firepower by placing friendly forces in a position to fire upon the enemy. Because firepower and maneuver are closely related, the defender's advantages in maneuver lead directly to advantages in firepower.

The defender's first advantage in maneuver is that he has less need to move than does the attacker. One of the defender's corresponding advantages in firepower is that he may position his weapons in suitable locations and then await the attacker. The defender has greater opportunity to fire from stationary, surveyed positions. Stationary positions are more easily supplied with ammunition and allow for more accurate fires. If the defender has time, he can pre-plan and even pre-register fires along expected enemy avenues of approach, which may make his fires even more accurate. The attacker must move forward, placing himself within the ranges of the defender's weapons. As the

attacker penetrates the forward defenses, he allows the defender to fire at him from multiple directions (Figure 2). Clausewitz considered such cross fire to be doubly effective and counted it as an important advantage of defense at the tactical level.¹⁶

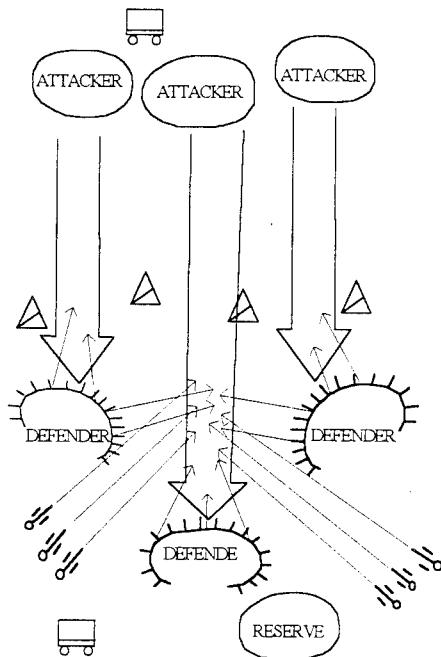


Figure 2--When the attacker penetrates the defense, the defender can fire at him from multiple directions.

The defender's fires will tend to be more accurate than the attacker's for another reason as well: the defender's ability to acquire targets is better than the attacker's. This is because the defender is stationary and can camouflage himself, while the attacker is moving and not only cannot camouflage himself, but draws attention to himself by his movement. The defender's advantages in target acquisition are related to general advantages in intelligence collection and dissemination, which will be further addressed under the combat power element of leadership. The advantages of camouflage and cover,

which make the attacker's fires both less accurate and less lethal, will be addressed under protection.

Using Wass de Czege's terms for evaluating firepower, the defender benefits from superior accuracy of fires, superior target acquisition, and superior lethality of munitions. The attacker, however, benefits from greater flexibility of employment and possibly superior volume of fires. Wass de Czege defines flexibility of employment as "the ability to concentrate fires of the right kind over a wide area in the desired amounts and at the right time."¹⁷ The attacker's primary advantage in firepower, as in maneuver, is that he chooses the time and place where he will direct his main attack. The attacker thus can concentrate his fires at the right time and place, while the defender must disperse his weapons to defend multiple points. Insofar as the range of weapons allows the defender to shift fires to bring his weapons to bear across his entire front, the attacker's firepower advantage is reduced. Increased range of weapons thus represents an asymmetrical advantage for the defense. Both sides benefit, but the defender benefits more.

The attacker may achieve a greater volume of fire than the defender by concentrating more weapons in the critical area. Longer range weapons may reduce the attacker's superiority by allowing the defender to position weapons to cover several avenues of approach. The defender can also offset some of the attacker's advantage in number of weapons by stockpiling or resupplying more ammunition per weapon; this is possible if weapons are stationary or can move between previously selected positions under the defender's control. The defender's weapons do not need to move to get in range of the attacker--the attacker will move to get in range of them.

The attacker may also benefit from the security provided by movement. A moving target is harder to hit than a stationary one. The more rapidly an attacker can move, the less accurate will be the defender's fires. This principle applies to an individual rifleman dashing from one covered position to the next or to an entire tank regiment moving from the rear area toward the front. The ability of either side to engage moving targets is largely a matter of the timeliness of the "sensor to shooter" link, which is discussed in the section on leadership.

The corollary to moving targets being harder to hit is that it is harder for a moving target to return accurate fire. This difficulty affects the attacker more than the defender because the attacker moves more. Weapons systems that can fire accurately on the move, such as tanks with stabilized turrets (*e.g.*, M1A1 Abrams), overcome this difficulty and tend to give an asymmetrical advantage to the attacker. Artillery systems such as the M109A6 Paladin that can fire from short halts also tend to give an asymmetrical advantage to the attacker.

In summary, the defender's advantages in firepower derive largely from the ability to fire from stationary positions against a moving enemy. The defender can position his weapons along likely enemy approaches and wait for the attacker to move within range. Defensive fires tend to be more accurate because the defender fires from stationary, prepared positions. Stationary positions also offer greater concealment and cover, which reduce the accuracy and lethality of the attacker's fires. If movement ceases to be an impediment to delivering accurate and effective fires, the defender's advantage will be

decreased. Likewise, if fires become so accurate and so lethal that entrenchments offer no protection, the defender's advantage decreases.

Protection

FM 100-5 states that "Protection conserves the fighting potential of a force so that commanders can apply it at the decisive time and place."¹⁸ Combat and non-combat hazards can diminish the strength of the force; protection addresses both. Non-combat hazards include accidents, exposure to the weather, hunger, disease, fatigue, equipment breakdowns, loss of supplies, and drains on the mental, moral, physical, and spiritual strength of soldiers. Combat hazards include enemy fires, reconnaissance, intelligence collection, psychological operations, electronic warfare, and deception activities. Combat hazards also include fratricide.¹⁹

Wass de Czege emphasizes three aspects of protection from combat hazards: personnel protection, equipment protection, and unit protection, both active and passive. He elaborates by stating that the three aspects of battlefield survivability are concealment (to avoid detection), exposure limitation (to avoid being hit once detected), and damage limitation (to limit damage from being hit).²⁰

The defender has a clear advantage in concealment. The defender is stationary and therefore can camouflage his positions, while the attacker must move and cannot camouflage as easily. Furthermore, the attacker must move into areas controlled by the defender. The defender therefore is able to observe the attacker's movement. The defender, on the other hand, moves in areas he controls. He can better mask his

movement from the attacker's observation, given favorable terrain. The attacker must send reconnaissance forward to observe the defender's movements. Clausewitz maintained that "ever since the right method of defense was adopted, reconnaissance has gone out of fashion--or, rather, it has become impossible."²¹ Since Clausewitz's day, ground reconnaissance has come back into fashion. It is not impossible, but it is much more difficult than passive surveillance of avenues of approach.

Often the first clue to the whereabouts of a defender comes when he opens fire on an approaching attacker. Some of the defender's advantage in concealment disappears once he fires; by firing (particularly for direct fires) the defender exchanges some of the benefit of superior protection for the benefit of superior firepower. The defender fires the first aimed shot. He risks disclosing his location, but the attacker thereby gains parity at best; if the defender's aim is true the attacker may be destroyed.²²

Concealment is thus an advantage of defense. The attacker may also use concealment, but less successfully. Night, fog, and smoke conceal both the attacker and the defender, but because the defender has other means of concealment, poor visibility gives the attacker an asymmetrical advantage. The same may be said for gullies, ravines, and forests that offer concealed means for an attacker to approach but also offer good concealment for the defender. However, ravines and forests often exact a penalty in mobility that more than offsets the advantage the attacker gains in concealment. Likewise, night and fog may penalize a moving force by reducing the ability to maintain cohesion and control.

The defender and the attacker use different methods to limit exposure--that is, to avoid being hit once detected. The defender builds fortifications, while the attacker tries to move quickly from point to point. The three second rush of an infantryman from one position to the next is an application of the latter method. On a larger scale, the rapid advance of an armored formation may make it difficult for a defender to bring effective fires against it. The effectiveness of movement as a means of exposure limitation depends on the accuracy, volume, and timeliness of the opponent's firepower. A three second rush is no use against a Sergeant York or an alert machinegunner, while a fifty meter bayonet charge may be quite successful against an opponent who has just discharged his Brown Bess.

The effectiveness of movement as a means of exposure limitation also depends on the opponent's ability to obstruct movement. During World War I, barbed wire did not in itself prevent attacking forces from advancing. Instead, it increased their exposure to defensive fires. Minefields and wire obstacles in an antitank kill zone have the same purpose. If the enemy must slow down or stop to clear an obstacle, he is more vulnerable to direct and indirect fires. A corollary to this is the principle that an obstacle not covered by fires is no obstacle.

The defender's primary means of exposure limitation is fortification. Although in some circumstances the attacker may employ trenches and other means of fortification, these are primarily tools of defense. Trenches, pillboxes, fortresses, bunkers, walls, trees, and boulders share a few characteristics, one of which is *they do not move*. This characteristic limits their usefulness to an attacker. The attacker may construct the classic

zig-zag of trenchlines that let him approach an enemy fortification, but this siege technique implies a slow-moving offensive. A more common situation is for an attacker to entrench on an objective in anticipation of the defender's counterattack; the attacker thus conducts a temporary defense.

Fortification includes use of natural cover, such as boulders and trees, but generally implies a degree of additional preparation. The longer a force occupies a position (to a point), the greater the degree of fortification it can prepare. By entrenching, or even by simply crouching behind a boulder or other protection, a defender reduces the size of the target he presents to an attacker. Compare the target presented by the entrenched defender with the target presented by the attacker who must move in the open (Figure 3).

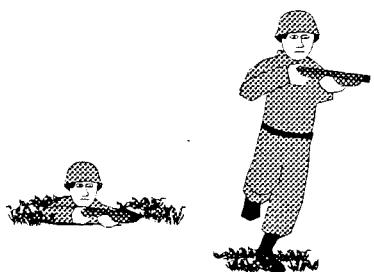


FIGURE 3--Comparative target sizes of an entrenched defender and an advancing attacker.

An attacking infantryman may crawl forward to limit his exposure, but he thereby slows his advance and makes coordination with his comrades more difficult, which in turn saps the courage needed to advance.²³

Exposure limitation is not the only benefit of fortification. Fortification also provides damage limitation--minimization of damage when hit by the opponent. Conventional artillery may rain down on well-constructed entrenchments for hours without causing critical damage, while the same artillery might wipe out exposed infantry in minutes. Fortification thus provides a dual benefit to the defense.

Fortification has certain drawbacks, however. A large fortress necessarily sacrifices concealment for cover. The opposing force is likely to determine the fortress's exact location during its construction and may be able to target it with weapons capable of defeating it. This happened to the Belgian fortresses of Namur and Liège in 1914.²⁴ A fortress may also be bypassed, as was much of the Maginot Line in 1940 or the fortress of Metz in 1870. A fortress's immobility means its strength cannot be applied if the enemy's attack is elsewhere. Instead, fortresses (including field entrenchments) tend to impose their immobility on the troops assigned to man them.

Fortification is not the only means of damage limitation. Armor--such as that of a medieval knight or a modern tank--serves the same purpose. Tank armor protects against fires. Other forms of protection limit damage from threats such as electromagnetic energy, poison gas, or lasers. Armor generally provides equal protection to the attacker and the defender. However, its effect is asymmetrical because the defender has other means of protection from fires (*i.e.*, fortifications) while the attacker generally does not. Advances in armor protection thus benefit the attacker to a greater degree than the defender.

Another approach to damage limitation is dispersion. Dispersion limits damage from area weapons such as conventional artillery, long-range machinegun fire, and nuclear bombs. It reduces the number of targets that may be hit within the effective area of enemy fire. Dispersion also provides some protection against enemy reconnaissance and intelligence collection, both by making targets harder to locate and by obscuring the location of an intended main effort. Both the defender and the attacker use dispersion to

limit damage; however, the attacker usually must sacrifice dispersion to achieve mass at the point of the main effort.

The defender has advantages in protection against non-combat losses as well as combat losses. The most important of these advantages is ease of supply. Resupply is easier in the defense because the defender is stationary and supplies move over areas the defender controls. In contrast, the attacker is constantly moving away from his supplies. An attacker's supply column must move forward across ground only recently wrested from the enemy. It must find the moving force it is supposed to supply. It then must return to its base for additional supplies--but the base itself may move in the meantime.

In summary, the defender has important advantages in protection that derive from his advantages in maneuver: less need to move and control of the ground over which he must move. The maneuver advantages give the defender greater ease of supply, better concealment, and the benefits of fortification for exposure and damage limitation. On the other hand, the attacker benefits from the protection provided by movement and gains an asymmetrical advantage from the protection of armor. Furthermore, fortification carries certain compensating disadvantages that an attacker may be able to exploit.

Leadership

According to FM 100-5, leadership is the most important element of combat power.²⁵ Leadership includes the motivation and direction of soldiers to achieve a particular purpose. Some disagreement exists as to whether it is easier to motivate soldiers to attack or to defend. The great Russian general, A. V. Suvorov, maintained it

was easier to lead troops in the attack.²⁶ Alexander the Great would likely have concurred.²⁷ On the other hand, S. L. A. Marshall has described the difficulty of getting soldiers to advance in modern infantry combat. Whatever the relative ability of leaders to *motivate* in defense or attack, the ability of leaders to *direct* is far superior in the defense.

Direction involves all the mechanics of battle command, including collection and dissemination of information about friendly and enemy forces, analysis of the battlefield situation, communication of instructions, and supervision of the execution of orders. Wass de Czege includes communications, intelligence, and tactical analysis as elements of maneuver, but this analysis will address them as essential aspects of the mechanics of leadership.

The defender has many advantages in the mechanics of battle command. The first advantage is knowledge about his own forces. It is easier for the defender to keep track of the locations of his major subordinate elements because they are not moving. If units have time--and in the defense they generally do--they can survey their positions and report to the higher commander. The information they report remains valid because the units stay in the position they reported. The attacker, in contrast, is moving. He has little time to survey his position, and whatever he reports to the higher commander is soon outdated. He may not know where he is; a moving unit can get lost more easily than one that sits still. This is most likely to happen at low levels, but can happen to larger units as well. During the 1973 Arab-Israeli War, Israeli Colonel Gabi's entire brigade traveled off course due to a map reading error.²⁸ The defender may also become lost while moving into position, but he is more likely to have time to correct the error.

Attacking units tend to become progressively more disorganized as they advance. Not only do some elements become lost (out of absolute position), but some elements may move faster than others and thereby get out of relative position. Moving in fog or darkness increases the difficulty, which is why night attacks are so rare in history.²⁹ Phase lines and other measures assist in keeping units in relative position, but it is still a difficult task. Furthermore, some means of improving control of moving forces do so at the expense of dispersion, security, or speed. Moving in convoys, for example, trades dispersion for control.

The advantages of having less need to move apply both to combat forces and to the command posts that attempt to control them. Well-manned staffs help to see and control the battle, but they entail large command posts. Unfortunately, large command posts take time to set up and tear down, and in a moving battle they may be ineffective. During the Persian Gulf War, the main command post of the 1st Armored Division became irrelevant once the ground attack began. It could not catch up with the advancing brigades long enough to set up and assume control of the battle.³⁰ A large command post in the defense need not move often or far and can even be dug in.

Another factor in the defender's superior ability to direct his forces is better communications. In Clausewitz's time, the two main means for commanders to direct troops were face-to-face meetings and the use of couriers. Both these means remain important today, and today as in Clausewitz's time, both means are easier for the defender. This is partly because defending units move less and are therefore easier for

couriers or commanders to find. Also, since the defender controls the ground, a courier or commander who moves forward in the defense is less likely to run into enemy forces.

Since Clausewitz's time, wire, fiber-optic cable, and radio (including satellite relay) have become essential means of communications. Wire (or fiber-optic cable) offers the best means of sending voice or data communications between fixed sites. It is difficult to intercept or jam and can pass a much greater volume of data than can radio. Fiber-optic cables can pass particularly large quantities of data. This is important for automated command and control systems that are of growing importance in modern warfare. Unfortunately, wire or cable takes time to lay and is vulnerable to fires, vehicle treads, and other hazards. These hazards usually cause the attacker to lose all wire communications when he crosses his line of departure.

Radios are a key means of communications in modern armies because they are mobile and reliable. However, radio communication has limitations. Radio can be intercepted or jammed, cannot pass as much data as wire, and has limited range. The attacker is more vulnerable to each of these drawbacks. The defender is better able to position radio intercept and jamming systems near where the attacker is in greatest need of using radio communications. The defender is less vulnerable to intercept and jamming because he can employ directional antennas and can position antennas on reverse slopes. The defender can ensure his radios are within range of one another and can reposition them if needed. The attacker is more likely to move out of range of his radio communications, as happened to some American units during the Persian Gulf War.³¹

Although the defender has some advantages in employing radio, the margin of superiority is not great. Radio benefits the attacker more than the defender because the defender may have alternate means of high speed long distance communications--wire and cable--whereas the attacker does not. As radio improves in security, range, and capacity, the attacker gains an asymmetrical advantage from the improvement. On the other hand, the defender may gain an asymmetrical advantage from improvements in automated command and control systems that are tied to wire, fiber-optic cable, or relatively immobile satellite communications links.

Larger command posts and superior communications give the defender advantages in seeing and directing his own forces. They also assist in receiving, processing and disseminating information about opposing forces. The defender has other advantages in intelligence as well. The attacker must move and therefore is generally easier to detect than the stationary defender. The attacker does not control the ground over which he must move, so obtaining information about his opponent is more difficult.

The oldest and still most common form of intelligence collection is human intelligence, or HUMINT. HUMINT includes the reports of spies, but it also includes the reports of front line troops, observation posts, and reconnaissance patrols, all of which are much more important than spies at the tactical level. As stated earlier, reconnaissance is more difficult than passive surveillance. The attacking side must use reconnaissance to obtain information about the defender, while the defender is able to rely more on passive surveillance to obtain information about the attacker. As the attacker closes with the

defender's front line troops, the concealed defenders are better able to see the attacker than vice versa.

Modern armies also employ signals intelligence (SIGINT) and imagery intelligence (IMINT) to learn about enemy forces. The defender is less vulnerable to SIGINT for reasons stated earlier: he can use directional antennas and reverse slopes and he can use wire communications. SIGINT also includes intelligence about enemy radars. The defender has some advantages in this area because his radar coverage does not need to extend as deeply into enemy territory. IMINT includes aerial photographs, synthetic aperture radar, and moving target indicator (MTI) radars. MTI radars, such as ground surveillance radar, side-looking airborne radar, and the U.S. Joint Surveillance and Target Acquisition Radar System (JSTARS), detect movement within an area. The airborne systems can cover thousands of square kilometers. These systems are less effective or useless for detecting stationary targets and therefore tend to favor the defender.

The attacker has a few advantages in intelligence collection. IMINT systems such as synthetic aperture radar or aerial photography are best at detecting and identifying stationary targets, such as forces in a defensive position. An aerial photograph of a moving force may be out of date by the time it is developed, but if the force is not moving the information remains valid. Unfortunately, aerial photographs and synthetic aperture radar images cover relatively small areas. They depend on cueing from other intelligence sources to direct the camera at the right spot; otherwise they may take pictures of empty terrain. More rarely, a defender may remain stationary and in the open for weeks and

months, as the Iraqi army did during Operation DESERT STORM. The coalition had time to photograph the entire Iraqi defense.

Defense and offense both have certain advantages in leadership, and the overall superiority of either is disputable. Attack has moral strengths that not only may make soldiers easier to lead, but may confuse and demoralize enemy leaders. In the mechanics of leadership, defense has a clear advantage. The defender has a markedly superior ability to see the terrain, his own forces, and the forces of his opponent. Such knowledge is a vital component of success. As Sun Tzu wrote, "Know the enemy and know yourself; in a hundred battles you will never be in peril."³² The defender's superior knowledge of the situation does not assure victory, but it does form an important part in the strength of the defense.

Time

At the moment of its inception, a defense has no advantages whatsoever. Once a defender stops and occupies a position he means to defend, he begins to develop the advantages of the defense. As Clausewitz wrote, "...time which is allowed to pass unused accrues to the credit of the defender." The defender uses the time to choose the best terrain, to verify the positions of his elements, and to plan his fires and counterattacks.³³ Without time, the defender is unable to exploit the strength of the defense. The attacker may therefore seek advantage by increasing the tempo of battle. A hasty attack against an unprepared defense is often preferable to a more deliberate attack several hours later.

The benefits of time have diminishing marginal returns. A defense that has two weeks to prepare may not improve appreciably given two more. Other factors, such as the limited availability of barrier materials, may cause a defense to reach its fullest development, after which additional time allows little improvement. Meanwhile, the debilitating effects of prolonged inactivity may tax the defenders more than the added time assists them.

III. Technology and the Balance of Offense and Defense

The effects of technology and doctrine can be evaluated based on how they influence the factors that make defense the stronger form of war. This section will focus on how technological change affected the balance of offense and defense during World War I and the Persian Gulf War. The discussion will then briefly consider the effects of technology in future war.

World War I: The Western Front

Following a brief war of maneuver in August and September of 1914, fighting on the Western Front settled into a prolonged stalemate. Many causes contributed to the failure of German and Allied offensives, but fundamentally they failed because the defense had gained overwhelming relative strength. We have seen images of trench warfare, and we marvel at the futility of human wave attacks across no-man's land. From the beginning of 1915 through 1917, offensive campaigns resulted in massive casualties but gained little or no ground.

Between Clausewitz's time and the beginning of the First World War, the defense gained several asymmetrical advantages over the offense. One such advantage was enormous improvements in infantry weapons. The basic infantry rifle of 1914 offered a great advantage in the defense over the musket of 1815. The rifle's longer range and increased rate of fire allowed the defender to fire many aimed shots at an approaching attacker, whereas a Napoleonic soldier might fire only once before his opponent closed with the bayonet. The defender's advantage was not merely that the attacker had to advance for greater distances under fire, but the attacker was visible to the defender as he did so. The defender, however, was often invisible, firing at extended range while in a prone or entrenched position and using smokeless powder.³⁴ The machinegun extended the asymmetrical advantage by increasing the firepower of the invisible defender.

The defender's advantages in firepower contributed to the failure of early offensives. As the offensives stalled, both sides dug in. The ensuing stalemate gave the armies time to improve their defenses; they began constructing trenchlines, setting out barbed wire entanglements, and laying telephone lines in depth across the entire front. The trenches strengthened the defense by giving protection to defenders that attackers had to forsake. Barbed wire reduced the tactical mobility of attackers. The telephone lines allowed defenders to call for reserves and to adjust artillery. In contrast, the attacker usually lost communications upon moving forward. Attackers attempted to lay wire as they advanced, but the wire was usually cut by artillery fire or accident.³⁵

The defense thus gained numerous asymmetrical advantages. The attacker gained few. His tactical mobility was the same as ever: walking. Indeed, the increased lethality

of firearms largely drove cavalry from the battlefield, actually reducing tactical mobility as compared to the Napoleonic era. The one major improvement in mobility, the railroad, was of little use to the attacker after he left his rail heads. When an attacking force managed to capture an enemy trenchline, it rarely could exploit the gain. Not only were the attackers by then badly attrited, but they could not call for reserves. If reserves came as arranged in some previous plan, they came only at walking pace, while the defender's reserves could arrive by rail to block the penetration.

To restore power to the offense, attackers had to overcome the basic strengths of the defense or find ways of obtaining asymmetrical advantages for the attack. Three notable efforts to increase the effectiveness of the offense were infiltration tactics, the rolling barrage, and the tank. Improvements in the airplane and wireless communications further aided the attack.

The Germans developed infiltration tactics on the Eastern Front and adapted them to the Western Front in 1917-1918.³⁶ Infiltration tactics consisted of sending specially trained storm troopers ahead of an attack. The storm troopers carried grenades, flame throwers, lightweight mortars, and light machineguns. The light weapons helped to overcome the firepower advantages of the defense without too severely reducing the attacker's mobility. Mortars provided fire support for the infantry after it lost communications with the artillery. The storm troopers would attack as deeply as possible, bypassing defensive strongpoints. They would then isolate the area by cutting telephone lines and blocking reinforcements. German artillery supported the attack by firing through

the depth of the battlefield to disrupt Allied artillery and reserves. The follow-on attacking forces could then defeat the bypassed defenders.³⁷

The effect of infiltration tactics was to deny the Allies control of the ground over which they had to move and communicate. Infiltration tactics thus undermined one of the basic sources of defensive strength. The tactics enabled the Germans to achieve remarkable results in their March 1918 offensive. Unfortunately for them, the successes were tactical, not operational or strategic. The storm troopers could not isolate the operational-level battlefield. The French and British were able to move reserves by rail to block German penetrations.³⁸

The Allies attempted both technological and doctrinal means to overcome the strengths of the defense. The doctrinal means included refinement of the rolling barrage. The barrage was a heavy concentration of artillery that shifted as the infantry moved forward. The infantry would advance as little as 25 meters behind the wall of incoming shells. The Germans who survived the artillery had no time to defend against the infantry. The rolling barrage attempted to gain for the attacker what is usually a basic strength of the defender: control of the ground over which he must move. The technique had poor success before 1918. The artillery often advanced too quickly. The infantry could easily be delayed by unexpected pockets of German resistance while the barrage moved on according to schedule. The infantry had no means to communicate with the artillery to adjust fires. Integration of artillery and infantry improved considerably by the end of the war, and the rolling barrage became an effective method of attack.³⁹

The Allies also attempted technological solutions. The most important was the tank.⁴⁰ The British first used tanks in small numbers at the Somme in September 1916; later at Cambrai (November 1917) they used 474 tanks in a generally unsuccessful attack.⁴¹ At Amiens in August 1918, the Allies used 592 armored vehicles in one of the greatest Allied victories of the war.⁴² The tank provided mobile protection, which gave an asymmetrical advantage to the offense.

The airplane represented a second important technological adaptation. The airplane was the primary means of obtaining information about the enemy in depth, since ground reconnaissance beyond the enemy's forward trenchlines was nearly impossible. Originally it added to the strength of the defense because it could identify the buildup of artillery and troops that indicated an impending offensive. Later it aided the offense by providing rudimentary close air support and by assisting to adjust artillery. The airplane greatly improved the integration of artillery and infantry toward the end of the war.⁴³ Airplanes with significant bomb payloads appeared in 1918, but the artillery and reconnaissance roles remained most important.⁴⁴

An important technological development that assisted aircraft in directing artillery was wireless communications. By 1917, radio-equipped aircraft provided ninety percent of the British artillery's counter-battery observation. Radios were too bulky and unreliable to accompany infantry attacks, but in the Allied offensives of the last hundred days of the war vehicle-mounted radios were able to provide unprecedented cooperation between infantry, tanks, aircraft, and artillery.⁴⁵

The defense was still much stronger than the offense at the end of the First World War. The successes of the late Allied offensives were largely due to overwhelming material superiority; even so they came at a high cost in blood. However, new technology had appeared on the battlefield--the tank, the airplane, and the radio--that would restore much of the relative strength of the offense during the Second World War.⁴⁶

The Persian Gulf War

The Persian Gulf War was not an even fight, and anyone who wants to derive lessons from it should exercise caution. Despite this, the war can be instructive. No other conflict has involved such large scale employment of the most modern technology.⁴⁷ The Persian Gulf War does not show the interaction of opposing forces that are both equipped with modern technology, but it does show how such technology can be used by an attacker to overcome the advantages of a defender.

Iraqi ruler Saddam Hussein apparently expected to derive the advantages of the defense should the U.S.-led coalition attack. Saddam may not have expected that his forces could defeat a determined coalition attack, but he apparently believed he could inflict high casualties that would deter an attack or to cause the Americans to stop.⁴⁸ He was not alone; some military “experts” writing for American journals estimated the United States forces would lose up to thirty thousand casualties.⁴⁹ Considering historical experience, the estimates might not have been unrealistic. The Iraqis had months to prepare their defenses. Their forces were dispersed and dug in, and their experience against Iran during 1980-1989 taught them that entrenched troops were difficult to

dislodge. Saddam could expect the coalition to have air superiority, but he may have assumed he could weather air attacks. Armored vehicles in revetted positions were hitherto considered relatively safe from air attack, and American aerial bombardment in previous wars had inflicted heavy civilian casualties without causing immediate significant harm to military capabilities.⁵⁰

Saddam was wrong. The coalition cut through his defenses quickly and with few casualties. Saddam's opponents deprived him of the advantages of defense. They turned the passage of time to their own advantage. They forced the Iraqis to move while minimizing the difficulties of their own movement. They denied the Iraqis control of the ground over which they had to move while retaining such control for themselves.

The Gulf War demonstrated the limitations of the advantage time usually provides for the defense. The five months between the Iraqi invasion of Kuwait and the coalition counteroffensive allowed the coalition to build up a force of over 600,000 troops and four thousand tanks.⁵¹ The coalition was able to develop detailed intelligence about Iraqi defensive positions and communications networks. Coalition ground forces had time to build mockups of the Iraqi defenses and use them to rehearse assaults.⁵²

The Iraqis were unable to make the "Saddam Line" as formidable as they might have hoped. Effective camouflage was nearly impossible in the open desert, and shortages of resources limited the Iraqi's ability to construct obstacles.⁵³ When the air war began, the coalition was able to attack Iraqi positions whose locations had been pinpointed (and had not changed) in the previous weeks and months. Precision weapons proved effective

against dug-in tanks and urban targets. Neither fortification nor dispersion over large areas offered much protection against precision weapons.⁵⁴

While Iraq gained few of the advantages of not moving, the coalition suffered few of the disadvantages of moving. After the ground offensive began, some forward elements of the U.S. VIII Corps and XVIII Airborne Corps had difficulty communicating with the rear, but despite this they were able to conduct a coordinated operation. The VII Corps suffered limited disorganization during its initial movement into Iraq and conducted an “operational pause” to regain order. General Schwarzkopf fumed, but the delay was minor.⁵⁵ The Iraqi desert allowed great mobility, and Ground Positioning Systems (GPS) helped the attacking forces navigate. Few Iraqi obstacles hindered the coalition advance way west of the Wadi al Batin. U.S. forces east of the Wadi were able to penetrate obstacles quickly using mine plows, bulldozers, and mine-clearing line charges (MICLICs).⁵⁶

The coalition sweep past the western flank of the Iraqi defenses forced the Iraqis to move to block this threat and to extricate forces from Kuwait before they could be cut off. Unfortunately for the Iraqis, coalition air attacks effectively denied them control of the ground over which they had to move. U.S. JSTARS aircraft were able to detect Iraqi movements and directed coalition aircraft against the withdrawing forces. The Iraqi columns were neither dispersed nor entrenched and suffered tremendous losses from area munitions.

The Iraqi's loss of the advantages of the defense at the operational level directly affected their defenses at the tactical level. When Iraqi soldiers stood their ground and

fought the advancing coalition forces, they found themselves outnumbered, outgunned, and outmaneuvered. They did not know when or where the attackers would come, but the attackers knew when and where they would find the defenders.⁵⁷ U.S. forces rained artillery on Iraqi positions, lifting fires when assaulting forces were only seconds away.⁵⁸ The defenders had no means of reducing the likelihood of being hit or of minimizing the damage from being hit. Their firepower was inferior--they could rarely kill an M1A1 tank. The theoretical advantages of the defense did not translate to real advantages for the Iraqis.

Iraqi defenders lacked the advantages this study has suggested should have been theirs. Not moving proved a trap rather than a boon, the attacker and not the defender controlled the ground over which he moved, and time proved a greater ally of the attacker than the defender. The results of the Persian Gulf War do not necessarily contradict this study's conclusions about the strength of the defense. The fight was uneven. To demonstrate the effects of new technology, both sides must employ it. Consider how different the Persian Gulf War might have been had the Iraqis possessed JSTARS, M1A1 tanks, Apache helicopters, Army Tactical Missile System (ATACMS), and a modern, well-trained air force. General Schwartzkopf's "Hail Mary" redeployment of two corps to the west would have been impossible: An Iraqi JSTARS would have detected it and Iraqi air and missile systems would have been able to stop it. A modern air force would have given the Iraqi army freedom to maneuver on the ground.

Most importantly, Iraq would not have had to stand by helplessly as the coalition built up its strength. Iraq would have been able to strike against Saudi Arabian ports and

airfields. Such strikes would not mean Iraq had gone over from a defensive strategy to an offensive one. Rather, the combination of deep-looking intelligence collection systems and long-range weapons would amount to a “reconnaissance-strike complex” that would blur the distinction between offensive and defensive fires.⁵⁹

Attack and Defense in Future War

The Persian Gulf War failed to demonstrate where modern technology has set the balance between offense and defense. Instead it demonstrated that the side with a significant technological superiority can achieve battlefield supremacy whether it is attacking or defending. Determining the balance of offense and defense could be difficult in any case. Defense may remain the stronger form of land war, but land war no longer exists in isolation. War has outgrown the Clausewitzian battlefield by moving into the air.

Clausewitz’s model in which attack has the advantage of initiative but defense is the stronger form does not apply well to war involving modern long-range precision weapons. Even before the Gulf War, Warsaw Pact observers asserted that such weapons allow the defender as much as the attacker to choose when and where the battle begins. They concluded that the traditional concepts of offense and defense could become obsolete.⁶⁰

Further complications in traditional concepts of attack and defense emerge from the offensive nature of long-range missiles and aircraft delivered munitions. ICBMs are useful for attacking; they cannot defend. Aircraft can defend, but the best defense may be to destroy the opponent’s aircraft on the ground. Air power advocates use these arguments to claim that the offense is the stronger form of air war.⁶¹ If the offense is the stronger

form of war, the only logical choice for anyone who decides war is likely is to strike first.

Is the aim of a preemptive attack positive or negative? Is the one who struck first the attacker or the defender? The distinction becomes unclear. Attack with a negative aim may be a form of defense.

In a war of aircraft and missiles, the offense may be the stronger form or the distinction between offense and defense may be blurred. In a war fought only with ground forces (excluding long-range missiles), defense is the stronger form. Future war will combine air and ground forces; the mix of each may determine whether attack or defense is stronger. The offense will be stronger if air forces and long-range missiles dominate the conflict. Ground forces may be relegated to mopping up after a decisive air campaign. Although ground forces may become the weak partner in such conflicts, they will not disappear. Missiles and aircraft cannot seize or hold territory; only ground forces can.

Ground forces must adapt to the environment of air and missile war. They can do so by acquiring effective anti-aircraft and anti-missile defenses and by dispersing--not in space but in capabilities. Large numbers of inexpensive systems can be individually too insignificant and collectively too numerous for long-range precision weapons to counter. The Mujahedin of Afghanistan may provide a model for future ground forces fighting under enemy-controlled skies. As Soviet helicopters roamed above them, they dispersed, hid, moved quickly--and struck back often and effectively.

Improving technology may enable anti-aircraft and anti-missile weapons to gain superiority over long-range surface attack weapons. This would allow ground forces to dominate the battlefield. The nature of the battlefield itself may allow ground forces to

dominate. The best precision weapons may be unable to destroy an enemy mortar inside a friendly village without destroying the surrounding buildings.⁶² If air forces cannot defeat ground forces, then other ground forces must do so. They will fight under the Clausewitzian model of war: the attack will have the positive aim, but the defense will remain the stronger form.⁶³

IV. Conclusion: Understanding the Sources of Defensive Strength

This study has examined the sources of defensive strength in an attempt to develop tools for evaluating the effect of future technology on the balance of offense and defense. The greatest advantages of defense appear to stem from its two key advantages in maneuver: the defender has less need to move than the attacker, and the defender controls the ground over which he must move. Most of the defender's advantages in firepower, protection and leadership derive from these two strengths. The defender can deliver superior firepower because he can fire from surveyed, concealed positions against an attacker who must move in the open through areas where the defender can engage him. Defensive fires are likely to be more accurate and more lethal. The defender benefits from the protection of superior cover, concealment, and ease of supply. The defender is able to exercise leadership through superior means of seeing the battlefield and directing his forces.

The attacker can attempt to overcome the advantages of the defense by taking away the basic sources of defensive strength or by reducing the advantages that derive from these sources. To overcome the defender's basic strengths, the attacker must force the

defender to move or must deny the defender control of the ground over which he moves.

The attacker may also seek asymmetrical advantages in technology or methods (including use of favorable terrain). The First World War provides good examples of both approaches. The creeping barrage and infiltration tactics involved only minor technological changes. They were primarily changes or refinements in methods. The tank was a technological approach to improving the strength of the offense.

In evaluating the effects of technology on the balance between offense and defense, we will often find that a new weapon or capability helps both sides, but it helps one more than the other. Understanding the sources of defensive strength helps to see how technological developments create asymmetrical advantages. For example, the defender generally moves less than the attacker and therefore is less likely to become lost; Ground Positioning System (GPS) therefore helps the attacker more than the defender because the attacker needs it more. Some other asymmetrical technological advantages for the attacker may be:

- Improvements in tactical mobility
- Improvements in wireless communications
- Improved armored vehicles
- Shoot-on-the-move capabilities

The defense may also gain asymmetrical advantages, such as from longer range weapons, improved fortifications, better antitank weapons, or improved means for laying obstacles. Improvements in military methods or technology that entail fixed or relatively immobile facilities may also offer an asymmetrical advantage to the defense. As an example, the railroad improved mobility but had an asymmetrical advantage for the

defense because the tracks themselves are immobile. During World War I, the defensive reserves could move laterally by rail more quickly than the attacker's reserves could move forward on foot.

Technology can offer the potential for asymmetrical advantages, but only doctrine can enable a force to exploit such advantages. The British introduced tanks at the Somme in 1916, but lacking appropriate doctrine the tanks accomplished little.⁶⁴ To develop appropriate doctrine, one must understand the potential effect of the technology. If a new weapon can help both the attacker and the defender, which side does it help most? Does the new weapon offer something to one side that the other already has? Does the new weapon take away something that one side depends on more than the other? Misunderstanding the effect of technology can lead to catastrophes such as the failed offensives of 1914. Although it may be impossible to fully grasp how new technology will affect future war, it is essential, as Michael Howard said, not to get things too badly wrong.⁶⁵

We should not imagine that modern technology guarantees us the ability to conduct such painless offensives as Operation DESERT STORM. New technology may favor the offense, but the decisive asymmetrical advantage in the Persian Gulf War was that the United States had the new technology and the Iraqis did not. Technology may have reduced the degree to which defense is stronger but it has not overcome the basic sources of defensive strength. Even if long-range precision fires in future wars obscure the difference between offense and defensive fires, close combat on the ground will not disappear; nor will the underlying factors in such combat that make defense the stronger form of war.

ENDNOTES

¹ United States Army, Field Manual 100-5, *Operations* (Washington, DC: U.S. Government Printing Office, 1993), 7-0.

² Sun Tzu, *The Art of War*. Translated and with an introduction by Samuel B. Griffith, with a forward by B. H. Liddel Hart (London: Oxford University Press, 1963, reprint 1982), 85.

³ Sun Tzu, 79.

⁴ United States Army, Field Manual 34-130, *Intelligence Preparation of the Battlefield* (Washington, DC: U.S. Government Printing Office, 1994), B-38.

⁵ United States Army, Field Manual 100-2-1, *The Soviet Army: Operations and Tactics* (Washington, DC: U.S. Government Printing Office, 1984), 2-11.

⁶ Clausewitz, 357.

⁷ Huba Wass de Czege, "Understanding and Developing Combat Power." Unpublished paper used as student text in U.S. Army School for Advanced Military Studies.

⁸ FM 100-5, 2-10.

⁹ Wass de Czege, 18.

¹⁰ The attacker can "maneuver by fire" without actually moving forces, but this is not true maneuver as defined in U.S. Army doctrine, as it does not seek or gain *positional advantage*.

¹¹ FM 100-5, (1993), 2-10.

¹² Clausewitz, 360. Restrictive terrain or other factors may of course limit the defender's ability to counterattack the attacker's flanks.

¹³ Clausewitz, 360.

¹⁴ Clausewitz, 357-358.

¹⁵ Clausewitz, 357-358.

¹⁶ Clausewitz, 360.

¹⁷ Wass de Czege, 18.

¹⁸ FM 100-5, 2-10.

¹⁹ FM 100-5, 2-10, 2-11.

²⁰ Wass de Czege, 22.

²¹ Clausewitz, 361.

²² John English, *On Infantry* (New York: Praeger Publishers, 1981), 127.

²³ S.L.A. Marshall, *Men Against Fire* (Gloucester, MA: Peter Smith, 1947, reprint 1978),

²⁴ Barbara Tuchman, *The Guns of August* (New York: Macmillan, 1962), 192.

²⁵ FM 100-5, 2-11.

²⁶ Bruce W. Menning, "Train Hard, Fight Easy: The Legacy of A. V. Suvorov and his 'Art of Victory,'" *Air University Review*, Nov-Dec 1986, 84.

²⁷ See Ardent du Picq, *Battle Studies*. Translated by Colonel John N. Greely and Major Robert C. Cotton. Reprinted in *Roots of Strategy Series*, Book 2. (Harrisburg, PA: Stackpole Books, 1987), 102. Du Picq points out that in ancient combat the attacker gained moral strength by advancing, while the defender was likely to become demoralized by the attacker's approach. He asserted the same phenomenon existed in modern (1850-1870) war when the attacker used the bayonet.

²⁸ Martin Van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), 219. Colonel Gabi's error proved fortuitous, as it allowed him to avoid Egyptian defenses.

²⁹ Clausewitz, 273.

³⁰ LTC Tom McCarthy, G3 staff officer in 1st Armor Division tactical command post during Operation DESERT STORM, interviewed by the author, Fort Leavenworth, KS, 16 Nov 94.

³¹ McCarthy interview.

³² Sun Tzu, 84.

³³ Clausewitz, 357-358.

³⁴ James J. Schneider, "The Theory of the Empty Battlefield" *Journal of the Royal United Services Institute*, Sep '87.

³⁵ John Keegan, *The Face of Battle* (New York: Penguin Books, 1983), 252.

³⁶ Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization* (Fort Leavenworth: Combat Studies Institute, 1984), 33.

³⁷ House, 35; Timothy L. Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*. Leavenworth Paper Series (Fort Leavenworth KS: Combat Studies Institute, 1981), 43-45.

³⁸ *Ibid*, 53.

³⁹ Keegan, 251-253; House, 37.

⁴⁰ The lightweight mortar and machinegun used so effectively by the Germans were originally developed by the British and French, respectively.

⁴¹ House, 29.

⁴² Fuller, 284, 295.

⁴³ House, 22.

⁴⁴ House, 28.

⁴⁵ Shelford Bidwell and Dominick Graham, *Fire-Power: British Army Weapons and Theories of War 1904-1945* (London: George Allen & Unwin, 1982), 145.

⁴⁶ Oliver Moss, "Searching for the Stronger form of War in the 20th Century: The Defense or the Offense." Monograph (Fort Leavenworth KS: SAMS, 1987) 38.

⁴⁷ Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey Summary Report* (Washington, DC: Government Printing Office, 1993), 235.

⁴⁸ Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (Boston: Houghton Mifflin, 1993), 95.

⁴⁹ David Hackworth, "We'll win, but..." *Newsweek*, 21 Jan '91, 26.

⁵⁰ Keaney and Cohen, 244.

⁵¹ Atkinson, 54.

⁵² Gregory Fontenot, "The 'Dreadnoughts' Rip the Saddam Line," *Army*, Jan '92, 33.

⁵³ Gregory Fontenot, interview by Stuart Whitehead, Fort Leavenworth, KS, 21 Nov 94.

⁵⁴ Keaney and Cohen, 244.

⁵⁵ Atkinson, 405-407.

⁵⁶ Gregory Fontenot, "The 'Dreadnoughts' Rip the Saddam Line," *Army*, Jan '92, 36.

⁵⁷ Although ground commanders were frequently dissatisfied with the amount of intelligence they received, they generally had a good picture of the Iraqi dispositions. See Gregory Fontenot, "Breaching Operations: Implications for Battle Command and Battle Space," *Military Review*, Feb '94, 23.

⁵⁸ Fontenot interview. Artillery fires for his armor task force were lifted when assaulting forces were 300 meters away; mortar fires were lifted at 150 meters.

⁵⁹ Keaney and Cohen, 237.

⁶⁰ Harold S. Orenstein, "Warsaw Pact Views on Trends in Ground Forces Tactics," *International Defense Review*, Sep '89, 1152.

⁶¹ John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, DC: National Defense University Press, 1988), 66.

⁶² Alvin and Heidi Toffler, *War and Anti-War* (Boston: Little, Brown, and Company, 1993), 181.

⁶³ How far into the future is future war? The arguments in this monograph applies best if the answer is "not very far." Some day space-based weapons may be able to zap specific individuals in hardened bunkers, making ground forces practically irrelevant.

⁶⁴ Fuller, 277-279.

⁶⁵ Michael Howard, "Military Science in an Age of Peace." Chesney Memorial Gold Medal Lecture Series, 3 October 1973.

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